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RECURRENT LUMBAR DISK HERNIATIONS: THE EFFICACY OF RE-OPERATION

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ABSTRACT

Objective: Lumbar disk herniations (LDH) are common in neurosurgical practice. However, recurrence is a fearful complication of LDH surgery and the re-operation technique is always on debate. The aim of this study was to analyze the efficacy of re-operation in patients with recurrent LDH.

Materials and Methods: The data of patients who underwent re-operation for treating recurrent LDH were retrospectively reviewed. The demographic, clinical, and radiological features of patients were analyzed, and visual analog scale (VAS) and straight leg raising (SLR) test results were compared.

Results: A total of 60 patients underwent re-operation between 2019 and 2022. The mean age was 48.3 years and the body mass index was between 30 and 35 in 28 (47%) patients. Patients who underwent simple discectomy had less early low back pain and patients who underwent posterior segmental instrumentation had lower lumbar and radicular leg pain VAS at the postoperative 1st year follow-ups. VAS scores and SLR tests were significantly improved after the re-operation in both groups. Dura defect occurred in 6 patients (10%) and was repaired successfully in all patients. No mortality was observed.

Conclusion: Re-operation is a feasible option for the treatment of recurrent LDH. VAS scores and SLR tests are improved after re-operation. However, appropriate patient selection is crucial for better clinical outcomes.

Keywords: Lumbar disk herniation, recurrence, re-operation, complication

INTRODUCTION

Lumbar disc herniation (LDH) is one of the common surgical routines of neurosurgery. One of the complications of surgical treatment is recurrence. After the first surgery, after a pain-free period for at least 6 months, the onset of low back and/or leg pain[1] and the radiological support of recurrence at the same level and/or from the same side, the diagnosis of recurrent LDH is made. Regardless of the duration, disc herniations that occur at the same level and/or on the same side after surgery are considered as recurrent LDH. Pseudo-recurrence is the term used for herniation that develops at a different level after the first surgery, even if the patient does not have a pain-free period. Recurrence rates after LDH surgery range from 7% to 26% in the literature[2-6]. Recurrence is most common at the level of L4-L5 with a rate of 69%[7]. It is followed by the L5-S1 level. It is thought that the L4-L5 level is the most active segment of the spine. Recurrence is more frequently seen in men compared to women with a rate of 58%. There are publications in the literature showing that female patients after spinal surgery are clinically worse than male patients. Ozger and Kaplan[8] found that there was no difference between the genders in the geriatric age group. Obesity has also been associated with various patient-related factors such as young age, male gender, heavy-duty work and smoking status, and alcohol use[9]. The surgical techniques in recurrent disc surgery are important for the surgeon, the patient and the society. Repeat mini-open microdiscectomy technique and decompression plus fusion technique are the options for re-operation. Preoperative radiological features of the patient is crucial for the appropriate selection of the surgical technique in recurrent disc herniations[10]. In this study, we aimed to analyzed our results on the re-operation of patients with recurrent LDH and to compare with the literature.

MATERIALS AND METHODS

The data of recurrent LDH that we operated in our clinic between 2019-2022 were retrospectively analyzed based on the incidenc, the most common level, the sex ratio, the mean age, the mean recurrence times, the patients' presence of fusion surgery, presence and repair of dura defect, Body Mass Index (BMI) of the patients, smoking status, preoperative/

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postoperative visual analogue scale (VAS) scores (Figure 1), pre- and postoperative examinations according to our previous surgeries of patients who were first performed in our center and straight leg raising (SLR) tests. Pre- and postoperative SLR and VAS scores were statistically compared.

Statistical Analysis

Parameters such as age, sex, BMI, smoking condition, VAS score, SLR condition, level of disc herniation, dura defect, posterior segmental instrumentation (PSI) and other quantitative parameters were analyzed. Categorized variables were explained as number of patients (n) and percentage (%) with descriptive statistics. The SPSS 15.0 for Windows program (Statistical Package for the Social Sciences Inc., Chicago, IL, USA) was used for statistical analysis. Two independent group comparisons were performed by student's t-test when the numerical variables provided normal distribution condition, otherwise the Mann-Whitney U test was performed. Statistical significance level was accepted when the p value <0.05. This study was approved by the University of Health Sciences Turkey, Gülhane Training and Research Hospital, Clinical Researchs Ethics Committee (decision no: 2022/164, date: 25.01.2023).

RESULTS

Between 2019-2022, we operated on 60 patients for recurrent LDH. Thirty-three (55%) patients were male and 27 (45%) were women. The mean age of the re-operated patients was 48.3 years (Table 1). When preoperative radiological examinations of all patients were examined before the first surgery, it was observed that there was no instability in any patient. We performed simple discectomy for microscopic discectomy in patients whose first surgery was performed in our clinic. BMI of 5 of 60 patients was <18.5 (8%), of 19 of them was between 18.5-29.9 (32%), of 28 of them was between 30-35 (47%), of 8 of them was >35 (13%), 2 of the male patients had a BMI <18.5 (6%), 13 of them had a BMI between 18.5 and 29.9 (39%), 13 of them had a BMI between 30-35 (39%), 5 of them had a BMI of >35 (16%). We found that 3 of the patients had a BMI <18.5 (11%), 6 of them had a BMI between 18.5-29.9 (22%), 15 of them had a BMI between 30-35 (56%), 3 of them had a BMI of >35 (11%) (Tables 2A, 2B). Thirty-two (55%) of the patients smoke regularly and 28 (45%) do not smoke. Twenty-two (67%) of male patients are smokers, and 10 (37%) of female patients are smokers (Table 3). We examined the VAS score of the patients who underwent discectomy and PSI in the same session for preoperative, early postoperative and postoperative 1 month and 1 year follow-ups for low back pain and leg pain. Each preoperative patient had low back and radicular leg pain. The mean VAS for low back pain was 7.49/10 and 8.29/10 for radicular leg pain. VAS 7/10 for low back pain in men, VAS 8.1/10 for low back pain in women, VAS 7.8/10 for radicular leg pain in men, VAS 8.9/10 for radicular leg pain in women, patients who had PSI in the same session with preoperative lumbar surgery rated 8.3/10, VAS 9.12/10 for leg pain (Table 4A). Average VAS 6.66/10 for early postoperative low back pain, mean VAS 3.87/10 for radicular leg pain, VAS 7.9/10 for low back pain in patients who underwent decompression and PSI in the same session, VAS 7.9/10 for leg pain (10 VAS evaluated as VAS 4B). VAS comparisons of the patients at the early postoperative

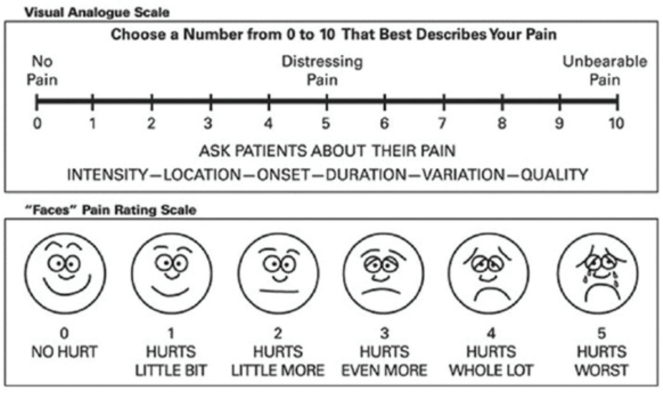

Figure 1. VAS scale
VAS: Visual analogue scale

Table 1. Distribution of patients based on gender

Total number of patient	Male patient	Female patient
60	33 (55%)	27 (45%)

Table 2A. Definitions for BMI

BMI	<18.5	18.5-24.9	25-29.9	30-34.9	>35
Definition	Weak	Normal	Overweight	Obese	Morbid obese

BMI: Body Mass Index

Table 2B. Distribution of patients based on BMI

Total patient	Male	Female	BMI
5 (88%)	2 (6%)	3 (11%)	<18.5
19 (32%)	13 (39%)	6 (22%)	18.5-29.9
28 (47%)	13 (39%)	15 (56%)	30-35
8 (13%)	5 (16%)	3 (11%)	>35

BMI: Body Mass Index

Table 3. Smoking condition

Total	Male	Female
32 (55%)	22 (67%)	10 (37%)

Table 4A. Preoperative visual analogue scale score in patients who underwent decompression and PSI

	Total	Male	Female	Decompression and PSI in the same session
Low back pain	7.49	7	8.1	8.3
Radicular pain	8.29	7.8	8.9	9.12

PSI: Posterior segmental instrumentation

1st month and 1st year controls are also available in Tables 4C and 4D. VAS scores were improved after the re-operation and this was statistically significant (p=0.015). Preoperative motor neurological deficit was present in 37 (62%) of the 60 patients we operated. We observed that motor neurological deficit progressed at a rate of 1/5 in the early postoperative period in 1 patient. We observed that the motor deficit was the same as the preoperative condition in the postoperative 1st month and 1st year follow-up, together with the physical therapy program. We observed that motor neurological deficit was improved more in the early postoperative period in 12 patients, and in 29 patients in total, the motor neurological deficit was improved in the postoperative follow-up compared to the preoperative period. At the preoperative examination, 37 patients (62%) had SLR positive. Preoperative SLR positivity was present in 12 (86%) patients who underwent decompression and PSI in the same session. In the early postoperative and postoperative 1st year examinations, the rate of SLR positivity decreased to 4 (6%) patients and 1 (2%) patient. In patients who underwent PSI, it decreased to 1 (7%) and it improved in the 1st year postoperatively (Table 5). The SLR was improved after the first year in re-operated patients and this was statistically significant (p=0.02). Eighteen patients relapsed left L4-L5 disc herniation (29%), 17 patients relapsed right L4-L5 disc herniation (27%), 17 patients relapsed left L5-S1 disc hernia (27%), 7 patients relapsed right L5-S1 disc herniation. We operated (12.5%), 2 patients for recurrent left L3-L4 disc herniation (3%), 1 patient for recurrent left L4-L5, left L5-S1 disc herniations (1.5%) (Table 6). We operated on average 33 weeks after the previous case. The first surgery of 39 patients (65%) was performed in the other hospital. The first surgery of 21 patients (35%) was performed in our clinic (Table 7). The mean recurrence time of patients who had their first surgery performed in our clinic was 36 months. Dura defect occurred in 6 patients (10%), and dura defect occurred in 1 (7%) of the patients who underwent PSI (Tables 8A, 8B). We performed duraplasty with fascia in 5 patients (83%), and in 1 patient with a synthetic graft (17%) (Table 9). We operated on 3 patients (5%) within the first week. We performed decompression and fusion in 14 patients (23%) in the same session. In every patient, we operated on, we put a drain in the operating room. The drains of the patients without dural defect and PSI were removed on the 1st postoperative day. Drains of patients with dural defect and patients who underwent PSI were removed on average on the 2nd postoperative day. Patients with no dural defect, who had only discectomy, were discharged on the 2nd postoperative day. Patients with dural defect and PSI were discharged on the 3rd or 4th postoperative day.

Table 4B. Early postoperative VAS score in patients who underwent decompression and PSI

	Total	Male	Female	Decompression and PSI in the same session
Low back pain	6.66	6.3	7.1	7.9
Radicular pain	3.87	3.6	4.2	3.8

PSI: Posterior segmental instrumentation, VAS: Visual analogue scale

Table 4C. Postoperative 1st month VAS score in patients who underwent decompression and PSI

	Total	Male	Female	Decompression and PSI in the same session
Low back pain	2.57	2.3	2.9	1.8
Radicular pain	1.93	1.8	2.1	1.6

PSI: Posterior segmental instrumentation, VAS: Visual analogue scale

Table 4D. Postoperative 1st year VAS score in patients who underwent decompression and PSI

	Total	Male	Female	Decompression and PSI in the same session
Low back pain	1.92	1.7	2.2	1.3
Radicular pain	1.63	1.5	1.8	1.2

PSI: Posterior segmental instrumentation, VAS: Visual analogue scale

Table 5. SLR comparion in patients who underwent decompression and PSI

	Total	Male	Female	Decompression and posterior segmental instrumentation in the same session
Preop SLR (+)	37 (62%)	26 (78%)	11 (40%)	12 (86%)
Early postop SLR (+)	4 (6%)	2 (6%)	2 (7%)	1 (7%)
Postop first year	1 (2%)	1 (3%)	0	0

PSI: Posterior segmental instrumentation, SLR: Straight leg raising

Table 6. Distribution of the patients based on level of disc herniation

Level	Number	%
Left L4-L5	18	29
Right L4-L5	17	27
Left L5-S1	17	27
Right L5-S1	7	12.5
Left L3-L4	2	3
Left L4-L5, Left L5-S1	1	1.5

Table 7. Distribution of the patients based on the first surgery

Total number of patient	First surgery in other center	First surgery in our department
60	39 (65%)	21 (35%)

Table 8A. Total number of dura defect

Total number of patient	Patients with dura defect	Patients without dura defect
60	6 (10%)	51 (90%)

Table 8B. Dura defect incidence in patients who underwent PSI

Number of patient who underwent PSI	Dura defect	No dura defect
14	1 (7%)	13 (93%)

PSI: Posterior segmental instrumentation

Table 9. Treatment of dura defect

Total patient with dura defect	Duraplasty with fascia	Duraplasty with synthetic defect
6	5 (83%)	1 (17%)

DISCUSSION

Re-operation in recurrent LDH is quite difficult compared to the initial surgery, especially due to dense granulation tissue and fibrosis. As a surgical technique, mini-open microdiscectomy is most frequently preferred technique for re-operation[10-13]. Fusion is not recommended in routine surgery[14]. Epidural fibrosis and scar tissue make it difficult to reveal the intervertebral disc anatomy clearly, but also increases the risk of complications such as dural defect and root injury. It is known that the amount of scar tissue is not associated with surgical outcomes and epidural scarring does not cause radicular pain unless it puts pressure on the nerve. Therefore, it may not be necessary to routinely target complete scar tissue excision in this situation, which may reduce the risk of dural rupture[15]. The most common complication of re-operation in recurrent LDH is dural tear. Our dural tear rate was 10%. Studies have shown that dural tear is 2.5 to 4.7 times more common in revision surgery than in primary surgery[16-18]. To reduce this rate, in patients without flavum hypertrophy, flavotomy can be performed at the first surgery to reveal the anatomy, thus reducing the possible recurrence of epidural fibrosis, which can facilitate our work in the next surgery. Facet joint instability is a possible cause of recurrent disc herniation, but it is difficult to diagnose a facet instability in these patients. Dynamic X-rays may give some information about the facet joint instability. Removal of the facet joints during the first surgery may contribute to the development of instability, as well as recurrence[19]. So, the instrumentation and fusion surgery may be inevitable in these patients. The concept of segmental instability has been defined by American Academy of Orthopedic Surgeons as "the occurrence of movement above normal when there is any load on the spine". When anatomical or physiological pathologies related to the vertebral body, intervertebral disc, facet joints, ligaments or muscles occur or after disc surgery, the subsystems cannot perform their normal stabilization function and spine instability develops as a result of enlargement in the neutral region[19,20]. As a result of the changes in the structures that keep the spine stable, the capacity to limit the movement decreases and the lumbar segment can move above the normal physiological limits. Especially after LDH surgery, the development of degeneration in the intervertebral disc, then the decrease in the height of the intervertebral disc, and the loosening of the ligaments, the load on the facet joints increases. Then the degeneration and deformation process begins in the facet joints. As a result of all these pathological changes, lumbar spinal stenosis, compression due to facet joint hypertrophy, facet separation, foraminal stenosis, hypertrophy of the ligamentum flavum, and loosening of the interspinous ligaments may occur. Then, spinal stability is lost and degenerative segmental instability

develops[20]. Instability that occurs after recurrent disc surgery is called secondary instability[21]. Although different rates of deviation and angulation have been reported, deviation of 3 mm or more on neutral radiographs and detection of 3 mm or more translation and angulation of 10 degrees or more on dynamic radiographs are accepted as "radiological instability" criteria (Figure 2)[22]. In the patient's previous surgery, both the patient's anatomical variation and the surgeon's preference, both the risk of recurrence increases and instability develops as a result of facet joint separation, and fusion is controversial in patients who have undergone medial facetectomy. Detailed examination of the patient's radiological imaging in the preoperative period, decrease in the height of the disc space in the magnetic resonance imaging study, development of listhesia in the lumbar computed tomography, hypoextension in the case of hyperextension (Figures 2A, B and 3) and calcified disc, wide decompression and PSI may be considered in hernias, since the total excision of the calcified material is difficult and the pressure on the spinal root cannot be fully removed (Figure 4). In addition, to reveal the normal anatomical structures without granulation intraoperatively, advancing superiorly and laterally, medial retraction of the root is performed by medial facetectomy, which may create an inflammatory process. Lumbar fusion reduces or eliminates segmental motion, stabilizes the spine, reduces mechanical stresses across the degenerated disc space, and may reduce the likelihood of recurrence in the affected disc area[23]. In previous studies, patients with recurrent discectomy and patients with recurrent LDH who underwent fusion without radiological instability were compared, and no statistical difference was found in patients' VAS, Oswestry Disability Index, and quality-adjusted life year scores and complication rates[24]. It is also known that patients who undergo simple lumbar discectomy have a faster recovery process and cause less cost than those who undergo fusion[25]. In addition, in patients with recurrent LDH surgery, in whom fusion is not performed but simple re-discectomy is planned, endoscopic surgery has become routinely used in recent years. This technique can be considered in appropriate cases due to the shorter hospital stay and lower complication rate[26]. Polat et al.[10] performed a retrospective study on the re-operation of recurrent LDH in 50 patients and they found that disc degeneration grade, degree of foraminal stenosis and facet joint degeneration, sagittal instability grade, facetectomy rate, adjacent segment degeneration and number of microdiscectomies are higher in patients who underwent stabilization. They also pointed out that preoperative radiological evaluation is important for proper surgical approach and low surgical risks[10]. In our study, we compared patients who underwent decompression and PSI in the same session with patients who had simple re-discectomy. We used VAS scores for the comparison of low back and radicular leg pains. Patients who had simple re-discectomy had less early low back pain. However, we found that patients

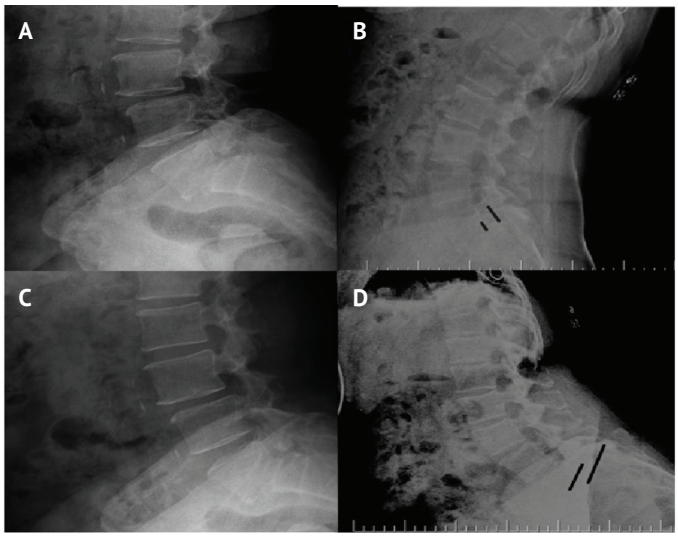

Figure 2. A-D) Instability can be shown in hyperflexion-hyperextension graphies by the measurement of translation and angulation

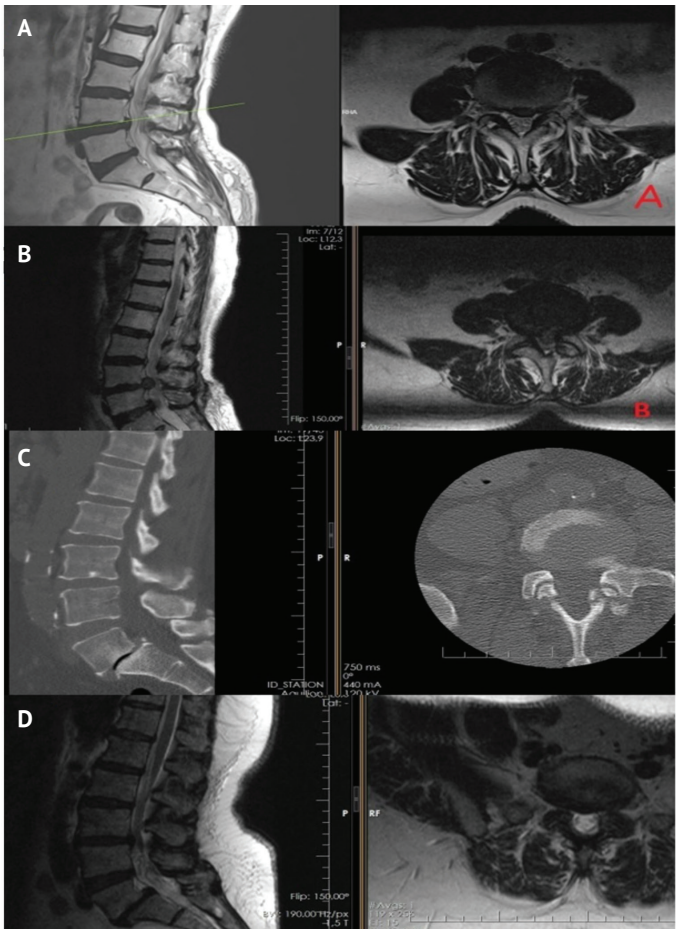

Figure 3. A) Preoperative (before the first surgery) T2 axial MRI of a patient with left L4-5 disc herniation. **B)** Preoperative (before the second surgery) T2 axial and sagittal MRI of the same patient. Disc height was reduced and facet joint was degenerated in this patient. **C)** Sagittal and axial lumbar CT scans show grade 2 spondilolisthesis. **D)** Sagittal and axial lumbar MRI scans show grade 2 spondilolisthesis
MRI: Magnetic resonance imaging, CT: Computed tomography

Figure 4. Calcified disc material at the L5-S1 level is seen on the sagittal lumbar CT scan of the patient
CT: Computed tomography

who underwent PSI had lower lumbar and radicular leg pain VAS at the postoperative 1st year follow-ups (Table 4D). We found that there was no significant difference in complication rates for both (p=0.1). We showed that VAS scores and SLR results of the patients who underwent re-operation for recurrent LDH are improved in the postoperative period if the appropriate surgical technique is selected. This is the strongest part of our study. However, low patient population and retrospective nature of the study are the limitations of this paper.

Study Limitations

Our research has some limitations. The first is the small number of cases. Second, because it is a retrospective study, the data were analyzed over the files, and the unsaved data of the patients could not be accessed.

CONCLUSION

LDH is the most frequently performed surgery in the neurosurgery routine. Recurrence of disc herniation continues to be an important problem in neurosurgery, both for the surgeon and for the patient, in both microscopic and endoscopic surgical approaches. Although there is still no consensus on the etiology of relapse, younger age, male gender, working in hard labor, smoking status, and the patient's anatomy are considered risk factors for recurrence. In addition, although re-operations cause physical and psychological difficulties for the patient, they also cause a significant cost in terms of workforce loss. VAS scores and SLR test are usually improved after re-operation. It is very important to decide on the type of surgery for recurrence by carefully examining the radiological images of the patient and to inform the patient about the possible outcomes.

Acknowledgments

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Ethics

Ethics Committee Approval: This study was approved by the University of Health Sciences Turkey, Gülhane Training and Research Hospital, Clinical Researchs Ethics Committee (decision no: 2022/164, date: 25.01.2023).
Informed Consent: Retrospective study.
Peer-review: Externally peer-reviewed.

Authorship Contributions

Surgical and Medical Practices: M.O.D., M.C.E., A.K., Concept: M.O.D., A.K., Design: M.C.E., A.D., Data Collection or Processing: M.C.E., Analysis or Interpretation: M.O.D., A.K., A.D., Literature Search: M.O.D., Writing: A.K., A.D.
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